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The values and benefits of environmental elements on housing rents

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ABSTRACT

The value provided by availability of environmental elements on human quality of urban life is difficult to assess and incorporate into urban planning and development. Researchers worldwide have seldom objectively factored these attributes into property pricing and associated decisions. This study contends that a better understanding of the effect of environmental elements requires systematic study of the relationship between objective and subjective measures of environmental phenomena and human responses. This paper summarizes the outcomes from applying Hedonic Pricing (HP) and Life Satisfaction (LS) methods – providing valuation in an increasingly expanding and privatized property Iranian market. A survey was carried out from 400 households that are more likely to make location choices and pay rent and property expenses in the city of Shiraz. The findings indicates that Shiraz neighbourhoods are likely to be characterized by deep environmental segregation. This study informs the decisions of policy makers and property developers regarding sales and purchases conversion, property development, urban nature conservation, and design of ecological green-space networks.

1. Introduction

Parks and urban green spaces, local shopping centres and in general good environments provide amenities and services that fundamentally contribute to the Quality of Urban Life (QUL) (Ardeshiri, 2014; Chiesura, 2004; Marans, 2015; Shafer, Lee, & Turner, 2000; Van Herzele & Wiedemann, 2003). Due to their unpriced nature and largely intangible benefits, however, it is difficult to assess and quantify this contribution. Valuing the quality of urban life, cities and citizens is often neglected in urban planning and policy making related to development (McConnell & Walls, 2005; More, Stevens, & Allen, 1988; Tajima, 2003; Tyrväinen & Miettinen, 2000). In recent years, increasing concern about environmental quality has grown in tandem with rapid urbanization. National and local governmental officials are facing the challenge created by growing populations and expanding infrastructure, providing quality built environments which accommodate growth, satisfying the changing needs of existing populations and preventing urban environmental segregation. The study of environmental segregation is an enduring feature of cities, the result of the distribution and availability of environmental elements, urban services and urban transformation in neighbourhood development. Previous research has highlighted that the economic structure of the city and the kind of restructuring that is going on are frequently seen to be among the most powerful forces (Musterd & Ostendorf, 2013) behind urban environmental segregation which can transform the quality of urban life (Caldeira, 1996).

In order to construct cognitive policies and decisions about developing the quality of the environment and preventing urban segregation among neighbourhoods, assessment of the urban environmental elements benefits, effects and its values is required. The concepts of urban environmental quality, liveability, quality of life and sustainability enjoy a great public popularity forming a central issue in research-programmes, policy making, and urban development. At least they do so in terms of the appearance of these terms in the respective literature. However, the manifestation and context in which environmental quality and quality of urban life is used in research and policymaking is seldom uniform. Various approaches have been proposed and tested, among which the hedonic pricing method widely applied in western countries to estimate the value of nature associated with settlements. For instance, the impacts of good urban environment within and near a

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development are examined for their impacts on housing prices to construct a housing price index (Anderson & Cordell, 1988; Bolitzer & Netusil, 2000; Bullock Craig H., 2008; Chattopadhyay, 1999; Chiesura, 2004; Geoghegan, 2002; Jim & Chen, 2006, 2009; Kong, Yin, & Nakagoshi, 2007; Luttik, 2000; Ogwang & Wang, 2003; Price, 2003; Schläpfer, Waltert, Segura, & Kienast, 2015; Tapsuwan & Polyakov, 2016). The life satisfaction approach represents a new nonmarket valuation technique built on the development of subjective well-being and quality of life research current in economics. This approach stands in a long tradition and debate of research measuring individual welfare.

This study aims to clarify the benefits and the values of environmental elements by investigating their impacts on residential rental pricing through a hedonic pricing method and life satisfaction approach in an Iranian city. Evaluating such benefits enhances understanding of the contribution of environmental elements on QUL and environmental welfare, as well as rental prices. In addition, such findings would throw light on urban segregation with regards to distribution of environmental and landscape elements as well as services within the urban neighbourhoods. The urban planning policy, however, often neglects the socio-economic value of environmental–ecological features. The results from this study will also help developers to rationalize investments and decision-makers to realize environmental improvement goals to prevent urban segregation. Finally this study will yield insights into theoretical modelling and applicability of hedonic pricing and life satisfaction method in Iran.

2. Research objective

In this study, environment refers to a local urban environment in which people are living. An urban environment is human built having population pressures. The quality of the urban environment as a living space for the people world-wide has emerged as an issue of fundamental concern for academic researchers, policy makers and citizens as the world's population largely lives in urban places.

QUL depends on quality of the environment. There are physical, biological, psychological, economic and social needs in a person's life met by resources from environment. QUL, from the standpoint of environment, is the degree to which the environment has capacity to provide resources necessary to meet the needs of human life (Bubolz, Eicher, & Sontag, 1979). The demand for environmental resources is always growing, but there is serious degradation in the capability of the environment to provide these resources. QUL is affected by the increasing gap between demand and supply of resources. Residents care about the appearance of buildings, public spaces, residents, proximity to shops, schools and parks, access to work the absence of crime and other nuisances. Nevertheless, the quality of a neighbourhood extends beyond daily experience.

Neighbourhood quality plays an important role for development, city officials, planners, realtors and researchers. In order for their construction projects to succeed, developers must understand the types of locations and amenities most valued by buyers. City officials sometimes upgrading neighbourhoods to combating social ills. In order to realise this, the planners preparing the upgrades must first learn about the qualities that are missing. Realtors, acting as intermediaries between buyers and suppliers of dwellings, assess the quality of neighbourhood before assigning a list price to a dwelling. Sociologists, geographers, economists and other scholars working in the wider field of urban studies are interested in the reasons why households relocate, why those relocating choose particular destinations and how the surrounding area figures into the housing price. Therefore, the main objective of this study is to present how environmental evaluation technique can be used as a tool to help the urban management system, developers, city officials, planners, realtors and researchers with policy making, decision making and city management procedures. In addition, it will help readers to evaluate environmental elements as a non-market good along with the priorities among the residents. It will represent the number of people willing to pay for urban services in their rent price and underscore the in the quality of urban life.

3. The statement of the problem and review of the literature

Shiraz is the sixth most populous city in Iran and the capital of Fars province. The population is 1.5 million and it is located in southwest Iran on the Roodkhaneye Khoshk (Dry River) seasonal river. The city of Shiraz includes 9 diverse zones (zones) (Fig. 1) in terms of their history and socioeconomic characteristics. Shiraz citywide planning authorities and municipalities are facing a particularly challenging task distributing the required environmental elements and services important to levels of satisfaction and QUL. This is a critical since the literature highlights that, while distributing capital and urban services among different municipalities, environmental segregation may occur.

Caldeira (1996) monitored spaces for residence, consumption, leisure and work arguing that abandoning the traditional public sphere due to insecurity, fear of violence, and lack of urban services makes it difficult to maintain the principles of environmental quality and quality of life which have been among the most significant organizing values of modern cities. Caldeira (1996) continued and mentioned that as a consequence, the character of public space and of citizens' participation in public life has changed. Over the past several decades, sociologists and demographers have devoted considerable attention to describing patterns of residential choice. In the 1990s this work mostly took the form of “locational attainment” models (Logan & Alba, 1993), which regress socio-demographic attributes of census households onto univariate measures of neighbourhood composition (e.g., median income, proportion black, etc.). In the 2006, Crowder and his colleagues used explicit measures of mobility from the panel's income study to examine correlations between respondents' wealth, income,,race/ethnicity and the probability of moving into or out of a neighbourhood characterized by its economic composition (Crowder, South, & Chavez, 2006; South, Crowder, & Pais, 2011). People attach meanings to the spaces where they live in flexible and varying ways and the factors influencing these readings and uses are endless. However, urban services with relative stability and rigidity are materials in neighbourhood environment that shape and bind lives determining the types of encounters possible in public environments. Contemporary urban segregation is complementary to environmental elements, services distribution and environmental quality. On the one hand, having access and approximation to services; On the other hand, the quality of these services becomes the context in which different neighbourhood stereotypes generate. The discussion and comparison of urban environmental elements and service availability and its quality can influence these topics in a society and quality of urban life. For example, position in the housing market, school participation, labour market, low security or even restricted socio-cultural integration affect the neighbourhood (Musterd & Ostendorf, 2013). It would be possible to argue that local participation between policy-makers and residents is increasingly necessary to make environmental elements and services available, make those neighbourhoods liveable and improve the quality of urban life.

Gaskin, Dinwiddie, Chan, and McCleary (2011) conducted a study on “Residential Segregation and Disparities in Healthcare Services Utilization”. They used office based location and accessibility as one of five measures of health care usage, the zip code to control for residential segregation. The finding from Gaskin et al.

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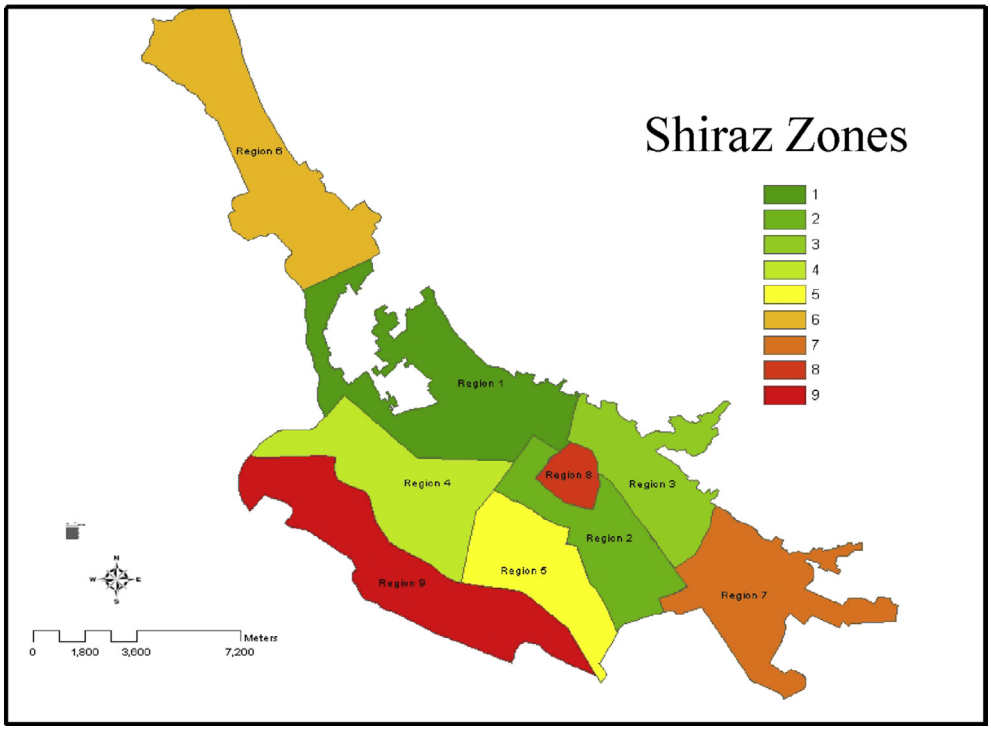

Fig. 1. Shiraz municipality zones.
Source: Shiraz Master Plan

(2011) study suggests disparities in health care utilization relates to distance and proximity. Efforts to improve healthcare access and eliminate healthcare disparities should not only focus on individual-level factors, but must also include community-level factors. A complementary study was conducted by Dinwiddie, Gaskin, Chan, Norrington, and McCleary (2013) on residential characteristics influencing opportunities, life changes and access to health services in the United States. They explored the role of residential segregation in access and mental health services utilization. The findings suggests, the segregated neighbourhoods can influence access and utilization of mental health services, as well as the availability of mental service in the neighbourhood. The same type of study was conducted for schools. Burgess, Wilson, &, Lupton (2005) studied school segregation suggesting that having schools in neighbourhood with high quality can cause significant segregation.

Most recently, a line of work has advocated discrete choice models that allow neighbourhood characterization based on multiple attributes; The include urban services, median income, neighbourhood attributes and housing prices (Ardeshiri, 2014; Bruch & Mare, 2006; Mare & Bruch, 2003). The discussion and comparison of availability and quality of urban environmental elements and services in a neighbourhood can influence different important topics in society and quality of life. This leads us to investigate Shiraz's environmental quality, general life satisfaction and to assess segregation in its local municipality zones.

4. Methodology – hedonic pricing and life satisfaction approach

Historically, there have been two basic approaches to examining QUL. The first involves monitoring QUL through a set of objective indicators usually time-derived from aggregated spatial data using official sources like the census considered to be related to perceived QUL (for example, household income, crime rates, pollution, housing costs, etc.). The second involves the use of sample surveys measuring peoples' subjective assessments of QUL domains. While the literature covering each of these approaches is extensive, few studies exist that use both objective and subjective approaches (see Marans & Stimson, 2011). In addition to offering a comprehensive view of QUL, the combined approach provides opportunities to examine relationship between both measures. This ability to analyse relationships has not only theoretical and scientific value, but informs policy makers on objective (environmental) conditions impact people's subjective requirements.

We have used two complementary and conceptually basic criteria – housing market price and life satisfaction – to recognize and understand objective and subjective components of QUL. The sale or rental prices of housing in a city is a synthesis of market values characteristics or attributes; not only those of a house itself, but those of its surroundings (Lora, Powell, Van Praag, & Sanguinetti, 2010). The hedonic approach provides a direct means of evaluating these types of interventions in monetary terms. Using the coefficients from the regressions, an implicit price can be estimated (expressed in monthly terms) for different housing and environmental attributes. The implicit price indicates how much the monthly rental of an average house would change with an additional unit of the specific characteristic. To name a few, Ardeshiri (2014), Jim and Chen (2006 and 2009), McConnell and Walls (2005) More et al. (1988) used hedonic price methods to estimate implicit values of local amenities. An alternative and complementary approach is to ask people how satisfied they are with their lives, their cities, and their urban environment. Recent literature has emphasized use of subjective satisfaction or happiness indicators to evaluate well-being: for example, Di Tella and MacCulloch (1998); Winkelmann and Winkelmann (1998); Gardner and Oswald (2001); and Frey, Luechinger, and Stutzer (2004). This is where life satisfaction comes into play. Although life satisfaction cannot be measured with the same precision as

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housing price, it can be fairly well approximated by means of a very simple question often included in QUL surveys. Life satisfaction is, in turn, a synthetic measure individuals give to all aspects of their lives, including the home and city where they live. Just as housing prices may not reflect all aspects of a city that affect well-being, an individual's life satisfaction may not depend on the same variables that affect housing prices. Satisfaction may depend, instead, on other conditions of the city, along with numerous individual factors, ranging from friendships and religious beliefs, to one's state of health and temperament (please see (Frey et al., 2004; Lora et al., 2010; Veenhoven, 2015). Therefore, these two approaches – the hedonic price approach and the life satisfaction approach – can be used complementarily to shed light on the impact and the value of environmental elements on residential rent price and the QUL concept.

Both approaches first may be used to calculate implicit prices for nonmarket goods; and then, with those prices used as weights, used to develop an urban QUL index. That index provides a summary of salient amenities affecting wellbeing. Such an index shows how value varies across neighbourhoods. Individuals may become a central policy instrument to guide decision-making: neighbourhoods with particularly low values might become areas for priority actions, individuals with particular characteristics might become the recipients of targeted polices. Underlying valuations then may be used to decide the value of different services, whether involving incentives to improve housing quality, urban amenities, and public goods, or involving efforts to reduce the negative impact of segregation.

5. Choice of indicators

The present research collected a wide variety of indicators and allowed the data to reveal which factors are important. Apart from general indicators-such as income, health, age and education-indicators pertaining particularly to urban QUL were collected. Those indicators may be divided into those related to housing characteristics and those related to environmental elements.

Regarding housing characteristics, typical indicators refer to the size of the house (number of bedrooms and bathrooms) and the building's quality of construction (structure, direction, materials). One important focus is the neighbourhood's access to the city. The distance to a bus stop, the quality of public transportation, the quality of roads and pavements, and the degree of traffic congestion may affect QUL. In addition, amenities such as parks, proximity to gardens (in Shiraz case, Ghasrodasht, Eram, Afif Abad, Hafezieh and Sadieh Gardens), cleanliness, density, even the abundance of trees are relevant characteristics. The other highly relevant areas for QUL are the proximity of educational institutions, commercial centres, health care facilities, leisure related venues, post offices and security stations.

Although those indicators are largely objective in nature, subjective measures and perceptions also may be used as well, especially in the LS approach. In particular, the surveys included questions about overall life satisfaction and satisfaction with housing quality and various neighbourhood features. But the overall LS variable is the dependent variable to be used in the LS approach, other subjective measures of access to and quality of different local public services and amenities may be incorporated into the analysis.

6. Description of Shiraz environmental quality survey (SEQS)

The research framework proposed for this study requires capturing data on the importance attribute of the place that respondents are renting as well as the beliefs individual hold regarding the availability and condition of environmental elements in the neighbourhood.

This study was designed as a four step data collection process;

1) A collection of primary data collected by the researcher from a household questionnaire that was design for this study (Table 1),
2) Gathering individual general satisfaction and satisfaction with life domains on a scale of 1–10 (Table 2)
3) Subjective environmental quality indicators collected at the street level (Table 3)
4) Calculating the distances (objective environmental quality indicators) of 9 individual urban service from each dwelling using GIS techniques (Table 4).

The sample size necessary for attaining a degree of representativeness for the city of Shiraz was beyond the resources and time available for this project. The data collection effort was thus conceived as a pilot program. The survey was paper-based, and conducted using trained interviewers. Respondents were randomly sampled. Based on the relatively equal distribution of the population within the 9 zones that constitute Shiraz, 45 respondents were sampled from all but one zone (only 40 respondents could be sampled from Zone 8, due to its relatively low population), making for a total of 400 respondents from households in Shiraz. The survey was directed at decision makers in the household, i.e. those more likely to make location choices and to pay the rent and property expenses.

The upper half of Table 1 summarizes the main demographic indicators of SEQS samples. The average age of respondents is 46 years, which is higher than the average in zones 1, 4 and 6. The majority of the respondents are male (65%).

Zones 4, 5 and 9 respectively have the highest proportion of respondents with diploma or lower education. Zone 8 has, by far, the highest level of respondents with some upper diploma education. Zones 6 and 1 have the highest proportion of respondents with a bachelor degree, at 36% and 28%, respectively. Finally, zones 7, 3, and 8 have the highest proportion of respondents with masters or above education. The average household income in Shiraz is 1.16 million Tomans, which is less than the average in zones 4, 1 and 6 and much higher than the average in zones 8 and 9. Income per capita, household size and number of children behave similarly: zones 4, 6 and 1 have the highest average per capita income and zones 6, 4 and 1 have the lowest average household size and number of children, respectively. Approximately 50% of the respondents in Shiraz are working in the private section, with zone 4 having the highest proportion, and 35% working for the government, with zones 8 and 2 with the highest proportion. Only 7% of the respondents are students, with zone 6 having the highest proportion. Zone 9 has the highest proportion of unemployed respondents, four times the Shiraz average, and zone 5 has the lowest at 0.1%. 63% of the respondents in Shiraz are married, which is higher than the average in zones 1, 4, 5 and 6.

The lower half of Table 1 presents a series of housing and dwelling characteristics. Zone 1 respondents are much more likely to own a house (instead of renting it) than the other zones. In addition, respondents in zones 5 and 7 have similar status; they are more likely to live in houses with gardens (instead of apartments). Average area of the properties is more or less similar among the zones. Respondents in zones 3 and 8 have been living in the same place for more than 18 years. Density of the units is higher in zones 1 and 6, due to the zone's renovation and the construction of new apartments. Dwellers in Shiraz benefit more from the sunlight during the day if their houses are oriented along the North–South axis (instead of the East–West axis). Therefore, there is greater

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Table 1
Summary statistics, household, respondent and property characteristics.

Variables	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Average
Household and respondent characteristics										
Age (Years)	32	55	53	38	51	34	50	49	51	46
Male respondents (%)	71	57	61	63	66	55	66	61	81	64
Diploma or lower education (%)	39	40	40	54	46	39	26	38	45	40
Upper diploma education (%)	22	34	23	20	23	13	23	46	31	26
Bachelor degree (%)	28	17	16	11	16	36	20	0.1	18	18
Master's degree (%)	7	1	9	11	10	10	23	15	4	10
PhD degree (%)	1	5	9	2	3	1	6	0.1	0.1	3
Total household income (in thousand Tomans)	1333	1142	1036	1334	981	1223	1060	712	770	1065
Per capita income (in thousand Tomans)	798	570	447	879	539	818	495	251	321	568
Household size	2.3	3.01	3.09	2.18	3.3	2.1	2.93	3.76	3.27	2.9
Number of children	0.77	1.79	1.36	0.64	0.97	0.58	1.07	1.85	1.45	1.2
Student (%)	8	3	2	6	6	21	0.1	0.1	0.2	5
Private employee (%)	72	21	33	81	43	55	63	15	36	46.5
Government employee (%)	17	73	61	6	50	15	30	76	45	41.4
Not employed (%)	0.7	1	2	4	0.1	7	6	7	18	5.1
Married status (%)	51	76	73	52	60	50	86	84	81	68
Property Characteristics										
Home owners (%)	62	51	54	50	50	47	53	23	9	44
Yards availability (%)	40	35	45	36	67	53	63	38	41	46.4
Parking space/garage (%)	95	71	57	77	70	84	70	38	55	68.5
Living in a house (%)	41	35	45	36	67	53	67	38	41	47
Store availability (%)	79	60	38	59	33	61	33	15	18	44
No. years living in the neighbourhood	14.1	13.6	18.9	11	10.6	16.6	7.2	18.4	9.2	13.3
Number of bedrooms	3.03	2.75	2.35	2.15	1.9	2.6	2.16	2	1.95	2.3
Number of bathrooms	2.13	2.06	1.83	1.59	1.5	1.42	1.43	1.61	1.63	1.7
Number of stories	3.43	2.38	2.43	3.2	2.1	3.32	2.23	1.85	2.68	2.6
Number of units	7.87	4.42	5.19	7.5	3.9	7.71	5	1.77	6.32	5.5
Floor area (M^2)	257.8	347.3	267.6	247.1	157.8	203.5	156.7	207.6	193.3	226.5
The residential is facing north–south (%)	93	57	47	61	56	71	40	30	31	54
Dwelling price per square Metre (in thousand Tomans)	1611	703	752	940	819	1341	775	421	677	893.2
Rent (in thousand Tomans)	1784	906	665	737	535	1221	541	391	476	806.2
Average tax block (in thousand Tomans)	108	63	47	69	34	50	26	142	24	62.5

Note: In the regressions, Property Characteristics correspond to PC variable.
Source: Author's calculations, based on the Shiraz Environmental Quality Survey.

Table 2
General satisfaction and satisfaction with life domains on scale of 1–10.

Type of satisfaction	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Average
General life satisfaction	5.6	3.4	2.3	4.7	2.6	5.0	2.7	2.1	2.7	3.5
Satisfaction with neighbourhood quality	5.3	4.4	4.0	4.6	4.3	4.9	4.1	3.0	3.5	4.2
Satisfaction with individual economic situation	5.1	2.7	2.8	3.2	2.9	4.0	2.7	1.6	1.8	3.0
Job satisfaction	4.3	3.5	3.0	3.6	3.3	3.9	3.1	2	2.5	3.3
Satisfaction with home	5.3	3.5	3.1	4.1	3.2	4.7	3.2	2.4	2.5	3.5
Simple average	5.1	3.5	3.1	4.1	3.3	4.5	3.2	2.2	2.6	3.5

Note: On the scale, 10 = the highest possible valuation for the Domain. In the regressions, general life satisfaction corresponds to *GS* variable. Neighbourhood QUL satisfaction corresponds to ZS variable.
Source: Author's calculations, based on the Shiraz Environmental Quality Survey.

demand for such dwellings. As the data shows, zone 1 has the highest number of residential places aligned in the North–South direction. Rental price are much higher in zones 1 and 6 than in other zones. Finally, by looking at the average tax value for each zone, zone 8 has the highest tax amount because of its central location and also having the old bazaar located in this zone. The new malls are located mainly in zone 1, increasing the average tax value in this zone.

The SEQS also collects extensive information on general life satisfaction and subjective satisfaction with a series of life domains. Results from these questions indicate specific patterns among the zones, as shown in Table 2. Neighbourhood levels of satisfaction revealed by answers to these questions are expressed on a 1 to 10 scale, with 10 being the highest possible valuation for the domain. Residents in more affluent zones report significantly higher levels of general satisfaction than those in less affluent areas. In this case zones 1, 6 and 4 have the highest levels of general satisfaction and zones 8 and 9 have the lowest. However, an average general satisfaction of 4 out of 10 in Shiraz indicates the dissatisfaction of residents with general life domains. In general, the lower levels of satisfaction are in poorer zones and the higher levels are in richer zones.

Table 3 presents a set of in-depth subjective evaluation of zone characteristics that are relevant to QUL. As in Table 2, the answers are on a 1–10 scale, covering such areas as sidewalk and street conditions, cleaning, security, green areas, population density, dweller density, air and noise quality, traffic and cycling conditions and building facade quality. Slightly the same pattern in general satisfaction appeared with zones, 1 and 6 the highest average with zones 8 and 9 averaging the lowest.

Table 4 gives the percentage of dwellers in the zone with a proximately of less than 800 m (network rout) to different urban services, produced via Service Area tool in GIS software (see Fig. 2 for more information) after the data were geo-referenced and

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Table 3
Subjective evaluation of zone characteristics on scale of 1–10.

Characteristic	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Average
Police Performance in neighbourhood	6.6	5.9	5	6.2	5.4	6.3	5.3	4.6	4.1	5.5
Traffic in neighbourhood	5.8	6.1	5.8	5.8	5.7	6.6	5.7	5.2	4.6	5.7
Noise pollution in neighbourhood	6	5.9	6	5.5	6.1	6.3	5.9	6	5.2	5.9
Air pollution in neighbourhood	6.5	6.9	6.3	6.2	6.1	7.2	6.5	6.8	6.4	6.6
Condition of streets	7.5	5.1	3.9	5.5	5.2	7.4	5.5	3.7	4.8	5.4
Condition of pavements	6.9	5.7	4.3	5.4	4.6	6.5	4.4	3.8	5.4	5.2
Safety for cycling	7.4	5.4	3.8	5.3	4.9	5.4	5.5	3.8	4.9	5.2
Garbage collection in neighbourhood	5.3	5.5	4.7	4.7	4.9	6.4	4.5	3.2	3.4	4.8
Neighbourhood cleanness	5.6	5	5.2	5.9	5.3	5.5	5.6	4.6	4.5	5.2
Street and sidewalk lightning at night	6.4	6.2	6.2	5.9	6	5.7	6.6	5.7	6.1	6.1
Building facades quality and condition	6.9	6.1	6.1	6.1	5.9	6.4	6.5	5.7	6.2	6.2
Density of the neighbourhood	5.7	6	5.9	5.4	5.7	5.7	5.3	5.4	5	5.6
Overpopulation in the neighbourhood	5.7	5.8	5.9	5.1	5.8	5.7	5.3	5.7	5.4	5.6
Amount and quality of green areas	6.8	4.9	5.3	6.2	5.5	6	5.4	4.6	4.9	5.5
Simple Average	6.4	5.8	5.3	5.7	5.5	6.2	5.6	4.9	5.1	5.6

Note: On the scale, 10 = the highest possible valuation for the characteristic. Zone evaluation corresponds to the *SC* variable in the regression.
Source: Author's calculations, based on the Shiraz Environmental Quality Survey.

Table 4
Objective evaluation of zone characteristics: Availability of services within 800 m of the Dwelling unit.

Characteristic	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Average
Educational facilities (%)	73	88	74	82	63	68	73	31	45	66.3
Religious centres (%)	29	71	43	52	40	24	33	100	45	48.6
Parks (%)	43	21	24	9	33	55	10	0	14	23.2
Bus stops (%)	92	98	93	98	100	100	73	38	82	86.0
Health facilities (%)	53	44	19	16	10	18	3	15	9	20.8
Security stations (%)	29	12	7	16	13	13	10	8	5	12.6
Leisure-related venues (%)	47	29	31	20	3	11	7	8	9	18.3
Commercial facilities (%)	48	29	38	39	47	42	23	38	14	35.3
Gardens (%)	72	2	21	11	0	37	0	0	0	15.9

Note: These Objective Characteristics corresponds to the *OC* variable in the regression.
Source: Author's calculations, based on the Shiraz Environmental Quality Survey.

matched to each surveyed household by residence block. People in the survey are asked to say how far they are ideally willing to walk for services, and the results suggests that they are willing to walk between 8 and 10 min (approximately 800 m).

Although about 86% of the dwellers in Shiraz have suitable walking access (800 m or less) to bus stop and 66% have access to educational facilities, access to other services is very limited for all zones especially zones 7, 8 and 9.

From a historical point of view, Shiraz main core was started from zone 8. Clearly from the data it can be observed that the local authority has a low tendency in capitalizing to renovate and develop the urban environment in this zone. This represents unequal management of capital among different zones in the city. These problems can be further highlighted in zone 9 as Shiraz's newest zone.

The results, so far, indicate the presence of three distinct sets of zones: zones 1, 6 and 4 have higher average income, relatively higher degree of satisfaction with their lives and living environment; zones 2, 5 and 7 maintain an average level of satisfaction in the city, and zones 3, 9 and 8 endure below average level satisfaction.

7. Inferring QUL at the Shiraz zones, using hedonic price regression

The data in Table 1 indicate that there are significant differences in the rent paid (or estimated, in the case of ownership) by respondents in each zone. A QUL index can be derived using the variables in the survey, exploiting the greater availability of zone characteristics in the data set.

The results present in Table 5 correspond to an ordinary least square (OLS) regression of the monthly rent value as a function of property characteristics (PC variable, from Table 1) and both objective (OC variable, from Table 4) and subjective evaluations (SC variables, from Table 3) in the regression. Therefore, the regression is of the following form:

$$Rent = \alpha + \sum_b \eta_b PC_b + \sum_c \theta_c OC_c + \sum_d \lambda_d SC_d \quad (1)$$

The results for housing characteristics in Table 5 are fairly standard. New homes with more bedrooms and bathrooms in cleaner, less populated, less congested, better maintained neighbourhoods nearer to gardens and security stations command a higher rental price. The negative and significant coefficient of Availability of Park within 800 m, may reflect the insecurity and unsafety in Shiraz parks. Finally, higher value of tax for the properties reflects its relative superior locale, services and accessibility.

These results (summarized in Table 6) indicate that better neighbourhood quality and accessibility to services increases the rent value. Using Shiraz average amount of rent value from the hedonic price regression (average value in thousand Tomans = 1317) as a reference, we can than compare the implicit price of OC and SC of each zone. For example the rental value of a two-bed, two-bath apartment, based only on zones objective characteristics (in this case access to services), in zone 1 is 174,960 (more than 13% of the average value) Tomans higher than Shiraz average value; if the identical dweller was located in zone 8 the rental value had a decrease of 22,650 Tomans. Respectively zones 1, 6, 4 and 3 have and premium of 174,960, 19,110, 12,050 and 5420 Tomans on Shiraz average rent value, and zones 5, 9, 2, 7 and 8

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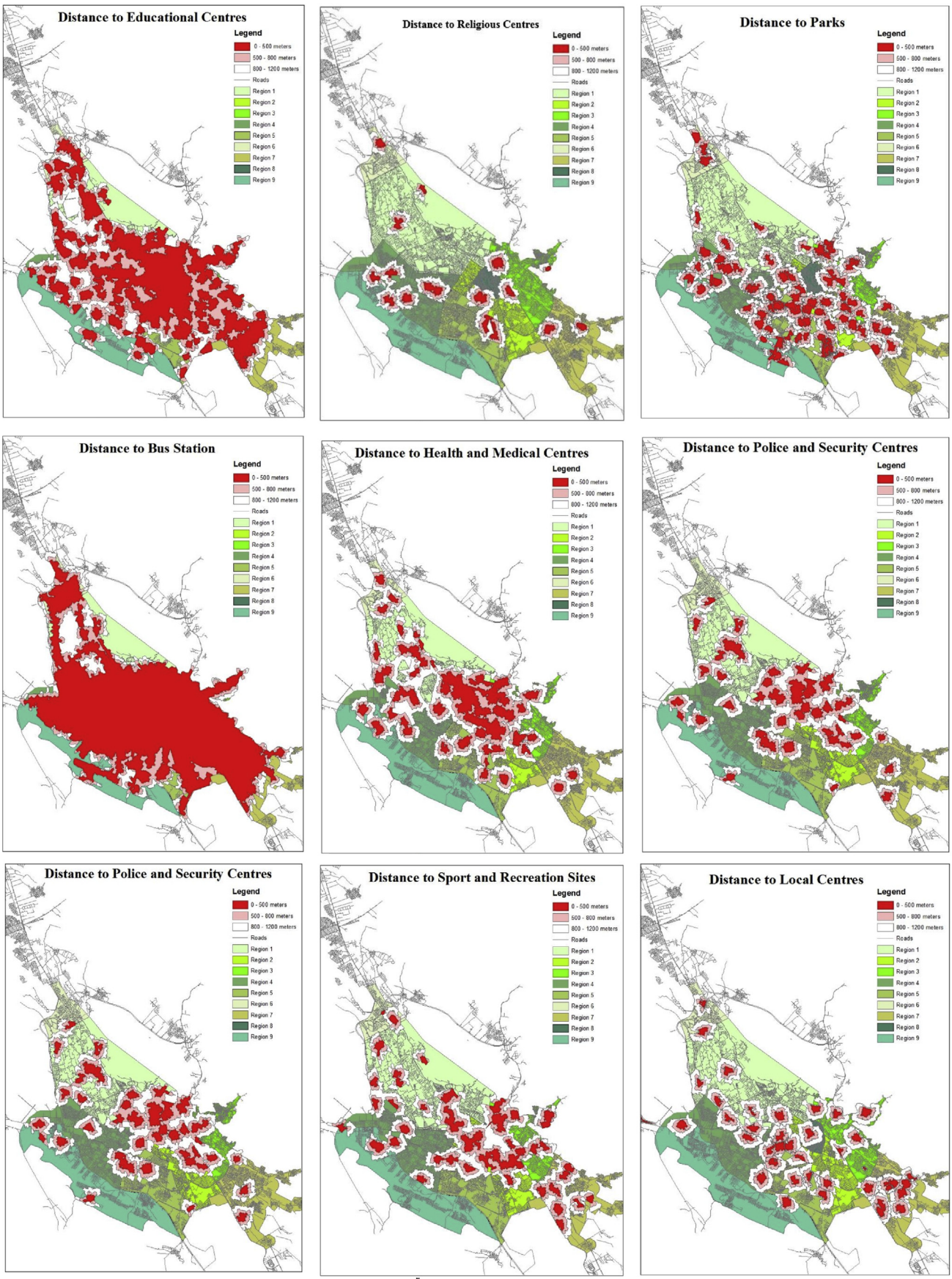

Fig. 2. Service area for different urban services in Shiraz.

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Table 5
Augmented hedonic price regressions for monthly rent.

Dependent variable: monthly rent			
Model	B	t	Sig.
(Constant)	−1467,801.2	−4.5***	0.000
Property characteristics (PC variable)			
Live in a house	910,007.6	11.2***	0.000
Years in neighbourhood	−6826.5	−1.8*	0.072
Bedrooms	471,203.9	10.5***	0.000
Bathroom	244,014.1	4.9***	0.000
Tax block	2.5	2.3**	0.021
Subjective characteristics (SC variable)			
Traffic	−392,322.7	−2.1**	0.042
Neighbourhood road condition	674,093.3	3.7***	0.000
Neighbourhood recycle collection	293,963.5	1.8*	0.065
Neighbourhood cleaning	340,303.4	2.1**	0.042
Neighbourhood population	528,116.2	1.9***	0.052
Objective characteristics (OC variable)			
Availability of park within 800 m	−151,594.5	−1.7*	0.096
Availability of police station within 800 m	171,082	1.8*	0.081
Availability of gardens within 800 m	315,098.3	3.5***	0.001
R2	0.684		

Note: Only variables with coefficients significant at the 10 percent level are included.
*P < .10 **P < .05 ***P < .01.
Source: Author's calculations, based on the Shiraz Environmental Quality Survey.

capitalized in property prices and wages (Gyourko, Kahn, & Tracy, 1999). An alternative strand of research, related to the happiness literature attempts to derive valuations for intangibles and externalities by studying the impact of the relevant factors on life satisfaction.

This section presents an extension of the alternative strand. The main difference consists of joint modelling of the relationships between income and general satisfaction, on the one hand, life satisfaction and neighbourhood QUL, on the other. This methodology computes the impact of the variables related to urban QUL in monetary terms.

QUL can be approximated through the general life satisfaction (GS) variable included in the SEQS data, whereas the NS variable provides information on neighbourhood satisfaction. A series of conditions need to be met to apply the two-equation valuation method to the neighbourhood QUL setting. First, a relationship must exist between general life satisfaction and Zone Satisfaction (ZS). Second, an unbiased estimator of the effect of ZS on GS must be available. Third, the zone's characteristics must be correlated with ZS. Finally, these characteristics must affect GS only through their effect on ZS (that is, they are exogenous to determination of GS). If these conditions are met, it is possible to estimate the

Table 6
Implicit price differences for SEQS.

Zone	Percentage of objective characteristics from Shiraz average rent Value	Implicit rent price difference base on objective characters (in 1000 Tomans)	Percentage of objective and subjective characteristics from Shiraz average rent Value	Implicit rent price difference base on objective and subjective characters (in 1000 Tomans)
Zone 1	13.3	174.9	26.2	345.4
Zone 2	−3.1	−41.3	−3.7	−48.7
Zone 3	0.4	5.4	−6.4	−84.7
Zone 4	0.9	12.0	1.0	13.0
Zone 5	−4.9	−64.1	−4.9	−63.9
Zone 6	1.4	19.1	13.4	176.2
Zone 7	−2.6	−34.4	−2.7	−35.2
Zone 8	−1.7	−22.6	−13.9	−183.2
Zone 9	−3.7	−49.0	−9.0	−118.8
Shiraz average rent value (in 1000 Tomans) = 1317				

Source: Author's calculations, based on the Shiraz Environmental Quality Survey.

respectively have a penalty of 64,130, 49,010, 41,340, 34,390, 22,650 Tomans on the average. Inclusion of a zone's subjective characteristics vary in the equation. Larger differences and reordering of some zones can be observed, with zone's implicit rent price difference based on objective and subjective characters, ranging from decrease of 183,160 Tomans for zone 8, to an increase of 345,380 Tomans in zone 1. Correspondingly, environmental quality of zones 1, 6, and 4 have a positive impact on rent value and zones 8, 9, 3, 5, 2 and 7 have a negative impact.

8. QUL in Shiraz zones: the LS approach

This section presents a further analysis of QUL, focussing on the interaction of subjective evaluations and objective indicators. The urban economic literature explains difference in QUL by city and sub-city area, assuming that city or neighbourhood amenities are

following system of equations:

$$GS = \alpha + \sum_{c} \beta_c X_c + \rho Y + \gamma ZS + \nu \quad (2)$$

$$ZS = \alpha_2 + \sum_{s} \phi_s SC_s + \sum_{c} \theta_c OC_c + \varepsilon \quad (3)$$

Where the X variables represent individual characteristics; Y is the level of income; ZS is zone satisfaction; GS is general satisfaction; and the other groups of variables represent objective and subjective zone characteristics: OC are objective geographic characteristics; SC are subjective evaluation of zone characteristics.

Under the conditions mentioned, Equations (2) And (3) can be estimated as a system, instead of sequentially, correcting for the probable endogeneity of ZS variable in the GS regression. This endogeneity bias is corrected by instrumenting ZS with the zone

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characteristic variable, resulting in an unbiased γ coefficient. A monetary valuation of zone amenities and characteristic then can be derived from their impact on general life satisfaction through their effect on zone satisfaction.

As a first approximation, the two equations in the system can be estimated independently. Because the dependent variables are both ordered on a 1 to 10 scale, the model is estimated by cardinal OLS (COLS), which first transforms all ordered variables (dependent and independent) to a form similar to the normal distribution and then applies OLS to estimate the model (for methodological details see van Praag and Carbonell (2004)).

The results from these simple regressions are presented in Table 7 (ZS regressions) and Table 8 (GS regression). Starting with the latter Table, the results match well established results in happiness literature (see (Oswald, 1997) among others): Life satisfaction increases with income, is lower for people without graduate qualifications, and decreases as age goes up. Marriage, gender family size and employment do not have a significant effect. Last and most interesting for the purpose of this study, the level of satisfaction with zone QUL (the ZS variable) has a positive and strongly significant effect on GS.

Regarding the determination of zone satisfaction, the results in Table 7 presents the estimation result of ZS as a function of OS and SC. From the objective indicators, health care centres, parks, leisure-related and commercial venues have a positive effect; only proximately to religious centres has a negative effect on the environmental satisfaction. The negative effect of having nearby religious institutions could be the consequence of having relatively lower levels of peace and quiet in the zone. The entire subjective variables have a positive effect on the environment, indicating the importance of safety and cleanliness with quality green areas and the value of infrastructure maintenance.

From this preliminary analysis, it appears that there is indeed a relationship between life satisfaction and zone satisfaction (GS and ZS) and that objective and subjective variables are relevant determinants of zone satisfaction. The latter result implies that the OS and SC variables might be appropriate instruments to correct for the potential endogeneity of ZS in the GS regression. The zone characteristics have an impact on general life satisfaction only through their effect on zone satisfaction.

The estimation results from Tables 7 and 8 can be used to compute QUL indicators. Table 9 reports the average valuation for Shiraz zones using only objective characteristics (first results column) and using the objective and subjective characteristics (second results column).

Table 7
Zone satisfaction regression.

Dependent variable: zone overall satisfaction			
Model	B	t	Sig.
Subjective characteristics (SC variable)			
Neighbourhood safety	0.253	6.8***	0
Neighbourhood noise pollution	0.074	1.9**	0.05
Neighbourhood sidewalk condition	0.067	1.8*	0.065
Neighbourhood cleanness	0.065	2.0**	0.043
Neighbourhood lightning condition	0.104	2.3**	0.021
Neighbourhood amount and quality of green areas	0.136	3.5***	0.001
Objective characteristics (OC variable)			
Availability of religious centres within 800 m	−0.028	−1.9*	0.059
Availability of parks within 800 m	0.034	1.9**	0.048
Availability of healthcare centres within 800 m	0.059	3.4***	0.001
Availability of leisure-related venues within 800 m	0.033	1.9***	0.061
Availability of commercial centres within 800 m	0.063	4.1***	0
R2	0.487		

Note: Only variables with coefficients significant at the 10 percent level are included.
*P < .10 **P < .05 ***P < .01.
Source: Author's calculations, based on the Shiraz Environmental Quality Survey.

Table 8
General life satisfaction regression.

Dependent variable: general satisfaction			
Model	B	t	Sig.
(Constant)	0.74	4.3***	0
Masters	−0.06	−2.2**	0.026
PhD	−0.19	−4.5***	0
Zone overall satisfaction	0.44	9.3***	0
Income	2.58E-08	1.9**	0.05
Log age	−0.31	−2.4***	0.016
R2	0.525		

Note: Only variables with coefficients significant at the 10 percent level are included.
*P < .10 **P < .05 ***P < .01.
Source: Author's calculations, based on the Shiraz Environmental Quality Survey.

The first column indicates that objective characteristics are valued relatively very little, on average, for the whole sample 5880 Tomans compared with the average income of 1,066,000. This value has a large variability between zones moving from zones 1, 6, 4 and 3 to the synthetic average zones required average compensation of 150,470, 22,930, 20,490 and 2440, respectively whereas zones 7, 5, 2, 9 and 8 would give up 41,270, 35,270, 31,030, 24,510 and 11,330 Tomans to move to the average zone.

Results from the second column of Table 9 computes the compensation based on all zone characteristics. The sample average compensation is 25.26, with average ranging from −91580 for zone 8 to 297,030 Tomans for zone 1.

Finally, Table 10 computes the correlation between the four indexes computed for the SEQS data set – two based on hedonic price regressions, and two based on the LS approach. The latter includes either objective variables only or all zone characteristics. The correlations between indexes based on different methodologies are all positive, indicating that the two methodologies at least partially account for some common underlying level of QUL.

The pervious discussion holds that the Hedonic and LS approaches should be considered complementary. The Hedonic regression revealed a set of housing and neighbourhood characteristics to be significant which implies that housing markets in the zones do function well in that they reveal considerable information about what individuals believe to be important. On the other hand LS regressions also exposed a set of variables to be significant. Although housing markets function, it is clear that they do not function perfectly. Showing that not all characteristics are priced appropriately at all times. Both sets of results should be considered relevant and be taken into account by policy makers.

The result may also respond to the policy making question of how to finance the provision of public goods. Amenities that are reflected in housing price may be financed through property taxes, and those reflected in life satisfaction may be financed through general taxation.

This research takes a broad view of what factors may be more significant for individual QUL. It is interesting to know that having a park within 800 m accessibility comes through highly important in both approaches. Although house prices reflect part of the value of living in a neighbourhood close to a park, they do not appear to reveal the full value of it. The monetary valuations from the hedonic regression in this instance are likely to underestimate the value of access to a park. On the other hand, Hedonic regressions find access to police is important. LS regressions generally do not find that to be true. Hence, the market may reflect the value of this characteristic more fully, and the valuations in the hedonic regressions then may be fully revealing. If they compare the results in this way, policy makers may use both sets of results to consider likely true

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Table 9
Monetized value of LS- Base Zone QUL index.

Zone	Income value of LS index, based on objective characteristics (in 1000 of Tomans)	Income value of LS index, based on all zone characteristics (in 1000 of Tomans)	Average monthly income (in 1000 of Tomans)
Zone 1	150.47	297.03	1333
Zone 2	−31.01	−36.54	1142
Zone 3	2.44	−38.13	1036
Zone 4	20.49	22.13	1334
Zone 5	−35.27	−35.18	981
Zone 6	22.93	211.46	1223
Zone 7	−41.27	−42.28	1060
Zone 8	−11.33	−91.58	712
Zone 9	−24.51	−59.40	770
Average	5.88	25.28	1066

Source: Author's calculations, based on the Shiraz Environmental Quality Survey.

Table 10
Correlation between hedonic and LS index.

		Hedonic regression		LS	
		Price difference, index based on objective characteristics	Price difference, index based on all characteristics	Income value of LS index, based on objective characteristics	Income value of LS index, based on all zone characteristics
Hedonic	regression	Price difference, index based on objective characteristics	1.000		
Price	difference, index based on all characteristics	0.675	1.000		
LS	Income value of LS index, Based on Objective Characteristics	0.311	0.201	1.000	
	Income value of LS index, Based on All Zone Characteristics	0.157	0.217	0.354	1.000

Source: Author's calculations, based on Shiraz Environmental Quality Survey.

valuations (Lora et al., 2010).

An implication of the finding that housing markets reveal a wide set of neighbourhood characteristics also suggests that Shiraz neighbourhoods are likely to be characterized by deep economic segregation. Segregation has received attention in the literature on urban economics, from both a theoretical and an applied perspective. Tiebout (1956) advances a theoretical model where inhabitants organize themselves into different areas, depending on their preferences for public goods. Different preferences imply an economic rationale for segregation. As Homogeneous subcity areas develop, they exacerbate segregation at the city level. This economic segregation contrasts with ethnic or other motives for segregation.

Lora et al. (2010) believes that the more segregated the urban area is, the more local governments may develop to serve the needs of each homogenous subcity zone. This is a prediction of the Tiebout model, borne out by evidence from the United States. Vandell (1995), in the extension of the same argument, holds that the higher-income families will outbid lower-income families for property with desirable characteristics. The result is that richer areas will cluster closer to desirable amenities. More generally, according to that view, market forces are likely to generate areas where residents have similar attributes, perhaps including neighbourhood characteristics such as natural features or parks and the provision of higher quality public services.

Therefore, it should come as no surprise that Shiraz is highly segregated, given that zone's high income inequality and the finding here that housing markets do reflect a wide set of public goods and bads. Moreover, the urban economic literature also concludes that rapid development of cities allows the demand for segregation to be both quicker and deeper.

9. Implications for policy and practice

The finding of this study will enable policy makers at both the national and local levels to identify which urban areas are disadvantaged, and to determine what actions will be most effective for improving the QUL there. The information generated may help individuals and firms make more informed decisions concerning where to live or locate and what to demand as a community from local and central governments.

Moreover, the results and the methods used in the present paper can be used to evaluating policies, locational ranking and formulating urban management and planning strategies. They can assist in understanding and prioritization of social issues for planners and urban managers to upgrade quality of life. The measurement QUL can be used as an environmental quality diagnosis for previous policy strategies, a foundation for drafting future spatial and urban planning policy.

In addition, studies of environmental quality can clarify the rationales for resident dissatisfaction, citizen's priorities, the results of social-demographic factors on quality of life, and, at the same time, monitor and evaluate the efficiency of policies and strategies in life quality.

It is both important and feasible for municipalities to monitor residents' QUL. The monitoring system should include both baselines and follow-up surveys for a representative sample of district citizens. The indicators to be collected should consist mainly of two types, which can be used simultaneously and complementarily:

1) Information on objective indicators, such as, number of bus stops, access to train station, distance to urban services, number and place of robberies and attempted robberies, frequency of street cleaning, and conditions of park and other services; as well as:

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2) Subjective information such as the level of satisfaction with municipality provided services. Given that QUL involves factors in addition to income and other socioeconomic indicators, the resulting data should be used to construct an urban and district-level QUL index that municipal officials may use to guide their activities and set priorities and monitor interventions. Furthermore, QUL estimations should be undertaken in all municipalities for benchmarking purposes.

Furthermore, valuation and assessment of environmental elements and its benefits are of crucial importance in order to justify and legitimise strategies for urban sustainability. It is arguable that valuation of worth to society must start from an appraisal of needs, wants and beliefs of the individuals composing that society. Public involvement, citizens' participation, along with the qualitative and quantitative appraisal of needs and interests, will help urban communities articulate commonly shared values; the latter can serve as reference criteria for local planners to envision more sustainable city strategies. As a result, an "Urban Build Environmental" action plan should be inextricably bound into processes of economic, environmental and social regeneration. Raising awareness of the value of urban environmental elements and services and their potentially key role in urban renewal, represents perhaps the best argument for a significant increase in resources, investment and political attention for urban segregation.

This research and its findings can benefit policy makers estimating the economic benefits of policy measures which improve the quality of life and direct them towards sustainable development. By employing the perspective of welfare economics to identify the structure of public preferences, including preference differences between socioeconomic groups, this study provides information informing city management and land use planning deliberations. This kind of research can prioritize different services developed in neighbourhoods with different socioeconomic backgrounds.

It is win–win strategy for residents and local government and can be very beneficial in increasing and maintaining residents' quality of life with a perspective of a city sustainability.

10. General discussion and conclusion

A first conclusion from the empirical analysis is the existence of some multidimensional QUL factor associated with zones characteristics. Similarity in the distribution of indexes for different methodologies bears witness to this. Moreover, whether based on the reflection of local amenities and characteristics in property prices or a subjective level of satisfaction, the two approaches suggest the environmental quality is of great importance. Different objective and subjective environmental characteristics can be monetized which enhancing urban public policy, making and improving the QUL. Information on the significant variables in the analysis could be collected on a regular basis to monitor the evaluation and impact of these urban public policy interventions.

Both the LS and hedonic approaches may be used to determine the actual monetary valuations of improvements in services or provision of better amenities. Moreover, comparing the LS and Hedonic approaches gives further insights. For example, where both approaches suggest that a particular issue is important, it is likely that both approaches underestimate true valuations. If a characteristic is found to be significant in the LS approach, it implies that markets are not fully reflecting individuals' true valuation. On the other hand, finding that a characteristic is not significant in the LS approach does not necessarily imply that there is no public policy concern. Furthermore, the results found using both approaches could be used to answer the very important policy question of how to finance provision of public services. Amenities that are reflected in housing prices are amenable to financing through property taxes, and those reflected by the LS approach may be financed through general taxation.

In addition, in the extreme case where markets fully reflect all valuations, economic segregation is likely to be very deep and cities are likely to be characterized by severe inequality in QUL. In turn, "spill-overs" between neighbourhoods may well reduce the QUL, one view in particular is that deep economic segregation feeds crime. Because the lack of sense of security may be the most serious issue found to affect QUL, the link between segregation and crime surely is an important issue for further analysis.

As the above findings show, this research and its findings can be very beneficial for policy makers to estimate the economic benefits of policy measures to improve the quality of life in cities and direct them towards sustainable development. By employing the perspective of welfare economics to identify the structure of public preferences, including preference differences between socioeconomic groups, this study provides valuable information which should help to inform public policy deliberations over city management and land use planning. This kind of research can prioritize among different services to be developed in the neighbourhoods among residents from different socioeconomic background. It is a win–win strategy for residents and local governments and can be very beneficial in increasing and maintaining quality of life and, from a wider perspective, a city's sustainability.

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